

THE MOTHS (LEPIDOPTERA) AND ASSOCIATED FLORA OF KELLEYS ISLAND, LAKE ERIE

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Abstract.—We surveyed the nocturnal Lepidoptera of Kelleys Island (Ohio, Erie County) within Lake Erie from 1999–2001, and found 216 species from 20 families. A logarithmic growth curve applied to our data suggests that the number of species obtained represents 65% of the number that would theoretically be captured after ten years of effort. We also list the 212 plant species found on the island to aid future efforts of moth/host plant associations.

Key Words: moths, Lepidoptera, vegetation, survey, Ohio

With more than 11,250 species recorded for North America (Hodges et al. 1988), moths (Insecta: Lepidoptera) provide an abundant food source as adults, larvae, and pupae to other trophic levels (i.e., predators and parasites), and constitute a significant proportion of terrestrial herbivores (Price 1997). The Ohio moth fauna has received a good deal of attention during the past two decades. Regional species lists have been compiled that give excellent data on the adult distribution and flight periods (e.g., Rings et al. 1987, Rings and Metzler 1989, Summerville et al. 1999, Teraguchi and Lublin 1999a–f, Rings and Downer 2001).

Kelleys Island is one of the Lake Erie islands situated off the north coast of Ohio. A portion of the island owned by The Cleveland Museum of Natural History is known as the North Coleman Tract, and has been designated a conservation area. However, other areas of the island are under development. We began a survey of the moths of Kelleys Island in an attempt to obtain data on this species-rich group before further environmental deterioration from human activities occurs. The only moth spe-

cies list was prepared by Nault et al. (1989), when they captured 11 species from three families during sweep netting. Use of light traps is a commonly used and effective technique for collecting nocturnal Lepidoptera, but transient species might be captured that do not breed in the trap area. Light trapping terrestrial insects on an island provides a more accurate look at the number of species per unit area and habitat use, as it is reasonable to assume that all specimens captured originated from the island.

We present the results of three years of light trapping for adult moths on the North Coleman Tract. Because of the strong tie between plants, moth oviposition, and larval development, we also give a listing of the vascular plants found on the island to aid future efforts of moth/host plant associations.

MATERIALS AND METHODS

Kelleys Island (OH, Erie County) is a 4.8 × 6.4 km island, positioned approximately 5 km north of the mainland city of Marblehead (Ottawa County). Moths were collected with a BioQuip® 15-watt black light trap

Table 1. Moth taxa obtained in light trap from Kelleys Island, including Hodges' number, the months collected, and the proportion of the total catch each species represented. A plus (+) indicates that the species listed most closely approximates the actual specimen taken.

Hodges #	Taxa	Month(s) Collected	Proportion
TINEIDAE			
372	<i>Acrolophus plumifrontella</i> (Clemens 1859)	July	<0.01
373	<i>Acrolophus popeanella</i> (Clemens 1859)	July–August	<0.01
OECOPHORIDAE			
1014 +	<i>Antaeotricha leucillana</i> (Zeller 1854)	May–August	<0.01
1046	<i>Callima argenticinctella</i> Clemens 1860	June–August	<0.01
COLEOPHORIDAE			
1387	<i>Coleophora spissicornis</i> (Haworth 1828)	June–July	<0.01
COSMOPTERIGIDAE			
1615	<i>Walshia</i> sp.	June, August	0.03
GELECHIIDAE			
2289	<i>Trichotaphe alacella</i> Clemens 1862	July	<0.01
2295	<i>Trichotaphe flavocostella</i> (Clemens 1860)	June–July	<0.01
PLUTELLIDAE			
2366	<i>Plutella xylostella</i> (Linnaeus 1758)	April	<0.01
YPONOMEUTIDAE			
2401	<i>Atteva punctella</i> (Cramer 1781)	June–August	<0.01
TORTRICIDAE			
2927	<i>Phaneta ochrocephala</i> (Walsingham 1895)	August	<0.01
2937	<i>Phaneta parmatana</i> (Clemens 1860)	August	<0.01
3116	<i>Eucosma dorsisignatana</i> (Clemens 1860)	August	<0.01
3120	<i>Eucosma derelecta</i> Heinrich 1929	August	<0.01
3202	<i>Epiblema otiosana</i> (Clemens 1860)	August	<0.01
3235	<i>Proteoteras moffatiana</i> Fernald 1905	June	<0.01
3404	<i>Dichrorampha simulana</i> (Clemens 1860)	June	<0.01
3492	<i>Cydia pomonella</i> (Linnaeus 1758)	June–August	<0.01
3597	<i>Argyrotaenia velutinana</i> (Walker 1863)	August	<0.01
3635	<i>Choristoneura rosaceana</i> (Harris 1841)	June, August	<0.01
3684	<i>Clepsis clemensiana</i> (Fernald 1879)	June	<0.01
3693	<i>Xenotemna pallorana</i> (Robinson 1869)	August	<0.01
3701	<i>Sparganothis pulcherrimana</i> (Walsingham 1879)	June	<0.01
3732	<i>Platynota flavedana</i> Clemens 1860	August	<0.01
ZYGAENIDAE			
4624	<i>Harrisina americana</i> (Guerin 1824)	June	<0.01
LIMACODIDAE			
4661	<i>Packardia elegans</i> (Packard 1864)	June	<0.01
4665	<i>Lithacodes fasciola</i> (Herrich-Schaffer 1865)	June	<0.01
4697	<i>Euclea delphinii</i> (Boisduval 1832)	June	<0.01
CRAMBIDAE			
4743	<i>Neocataclysta magnificalis</i> (Hubner 1796)	July	<0.01
4755	<i>Synclita oblitalis</i> (Walker 1859)	June–August	<0.01
4895	<i>Chalcoela iphitalis</i> (Walker 1859)	June, August	<0.01
4944	<i>Crocidophora serratissimalis</i> Zeller 1872	August	<0.01
4949	<i>Ostrinia nubilalis</i> (Hubner 1796)	June, August	<0.01
5071	<i>Pyrausta acronialis</i> (Walker 1859)	July–August	<0.01
5079	<i>Udea rubigalis</i> (Guenee 1854)	April–September	0.02
5142	<i>Diacme elealis</i> (Walker 1859)	July	<0.01

Table 1. Continued.

Hodges #	Taxa	Month(s) Collected	Proportion
5156	<i>Nomophila nearctica</i> Munroe 1973	June–September	<0.01
5159	<i>Desmia funeralis</i> (Hubner 1796)	June, August	<0.01
5226	<i>Palpita magniferalis</i> (Walker 1861)	May	<0.01
5280	<i>Herpetogramma aeglealis</i> (Walker 1859)	August	<0.01
5357	<i>Crambus leachelhus</i> (Zincken 1818)	September	<0.01
5361	<i>Crambus albellus</i> Clemens 1860	June	0.01
5362	<i>Crambus agitatellus</i> Clemens 1860	June–August	0.12
5378	<i>Crambus laqueatellus</i> Clemens 1860	June	<0.01
5379	<i>Crambus luteolellus</i> Clemens 1860	July	0.03
5403	<i>Agriphila vulgivagella</i> (Clemens 1860)	August–September	<0.01
5413	<i>Pediasia trisecta</i> (Walker 1856)	July–September	<0.01
5420	<i>Microcrambus elegans</i> (Clemens 1860)	July–August	0.06
5435	<i>Fissicrambus mutabilis</i> (Clemens 1860)	August	<0.01
5464	<i>Urola nivalis</i> (Drury 1773)	June–July	<0.01
5492	<i>Eoreuma densella</i> (Zeller 1881)	July	<0.01
5524	<i>Hypsopygia costalis</i> (Fabricius 1775)	September	<0.01
PYRALIDAE			
5566	<i>Arta statalis</i> (Grote 1875)	July	<0.01
5579	<i>Epipaschia zelleri</i> (Gorte 1876)	June	<0.01
5799	<i>Nephoterix basilaris</i> Zeller 1872	August	<0.01
5804	<i>Nephoterix rubrisparsella</i> (Ragonot 1887)	June, August	<0.01
5944	<i>Homoeosoma deceptorium</i> Heinrich 1956	July	<0.01
5946	<i>Phycitodes albatella</i> (Ragonot 1887)	June	<0.01
6005	<i>Moodna ostrinella</i> (Clemens 1860)	August	<0.01
PTEROPHORIDAE			
6204	<i>Oidaematophorus elliotii</i> (Fernald 1893)	June	<0.01
THYATIRIDAE			
6235	<i>Habrosyne scripta</i> (Gossbeck 1840)	July	<0.01
GEOMETRIDAE			
6270	<i>Protitame virginalis</i> (Hulst 1900)	June	<0.01
6322	<i>Mellilla xanthometata</i> (Walker 1862)	August	<0.01
6353	<i>Semiothisa multilineata</i> (Packard 1873)	July	<0.01
6362	<i>Semiothisa continuata</i> (Walker 1862)	July	<0.01
6419	<i>Enconista dislocaria</i> (Packard 1876)	May–July	<0.01
6590	<i>Anavitrinela pampinaria</i> (Guenee 1857)	August	<0.01
6640	<i>Biston betularia</i> (Linnaeus 1758)	August	<0.01
6654	<i>Hypagyrtis unipunctata</i> (Haworth 1809)	June	<0.01
6667	<i>Lomographa vestaliata</i> (Guenee 1857)	June	<0.01
6720	<i>Lytrosis unitaria</i> (Herrich-Schaffer 1854)	June	<0.01
6724	<i>Euchlaena serrata</i> (Drury 1770)	June	<0.01
6725	<i>Euchlaena muzaria</i> (Walker 1860)	June	<0.01
6726	<i>Euchlaena obtusaria</i> (Hubner 1807–13)	August	<0.01
6729	<i>Euchlaena johnsonaria</i> (Fitch 1869)	June, August	<0.01
6740 +	<i>Xanthotype</i> sp.	August	<0.01
6753 +	<i>Pero</i> sp.	May–August	<0.01
6822	<i>Metarranthis duaria</i> (Guenee 1857)	June	<0.01
6826	<i>Metarranthis hypocharia</i> (Herrich-Schaffer 1854)	May–June	<0.01
6941	<i>Eusarca confusaria</i> Hubner 1813	May–September	0.03
6964	<i>Tetracis cachexiata</i> Guenee 1857	June	<0.01
6982	<i>Prochoerodes transversata</i> (Drury 1770)	September	<0.01
6987	<i>Antepione thisoaria</i> (Guenee 1857)	May	<0.01
7009	<i>Nematocampa limbata</i> (Haworth 1807)	June	<0.01
7053	<i>Dichorda iridaria</i> (Guenee 1857)	May–June	<0.01

Table 1. Continued.

Hodges #	Taxa	Month(s) Collected	Proportion
7132	<i>Pleuroprucha insulsaria</i> (Guenee 1857)	June, August	<0.01
7146	<i>Haematopis grataria</i> (Fabricius 1798)	September	<0.01
7159	<i>Scopula limboundata</i> (Haworth 1809)	June, August	<0.01
7169	<i>Scopula inductata</i> (Guenee 1857)	June–July	<0.01
7196 +	<i>Eulithis</i> sp.	June, July, September	<0.01
7414	<i>Orthonama obstipata</i> (Fabricius 1794)	April, June, July, September	0.02
7416	<i>Orthonama centrostrigaria</i> (Wollaston 1858)	June–August	0.01
7445	<i>Horisme intestinata</i> (Guenee 1857)	August	<0.01
7474 +	<i>Eupithecia</i> sp.	April–September	0.05
LASIOCAMPIDAE			
7670	<i>Tolype velleda</i> (Stoll 1791)	September	<0.01
SATURNIIDAE			
7746	<i>Automeris io</i> (Fabricius 1775)	June	<0.01
SPHINGIDAE			
7871	<i>Deidamia inscripta</i> (Harris 1839)	April–May	<0.01
7885	<i>Darapsa myron</i> (Cramer 1780)	June	<0.01
NOTODONTIDAE			
7896	<i>Clostera inclusa</i> (Hubner 1829–31)	May	<0.01
7901	<i>Clostera apicalis</i> (Walker 1855)	July	<0.01
7902	<i>Datana ministra</i> (Drury 1773)	June–July	<0.01
7904 +	<i>Datana</i> sp.	June–July	<0.01
7906	<i>Datana contracta</i> Walker 1855	June–August	<0.01
7907	<i>Datana integerrima</i> Grote and Robinson 1860	July	<0.01
7908	<i>Datana perspicua</i> Grote and Robinson 1865	July	<0.01
7915	<i>Nadata gibbosa</i> (Smith 1797)	June, August	<0.01
7920	<i>Peridea angulosa</i> (Smith 1797)	June	<0.01
7929	<i>Nerice bidentata</i> Walker 1855	June	<0.01
7930	<i>Ellida canaplaga</i> (Walker 1856)	April, August	<0.01
7931	<i>Gluphisia septentrionis</i> Walker 1855	August	<0.01
7985	<i>Heterocampa subrotata</i> Harvey 1874	June–July	<0.01
7994	<i>Heterocampa guttivitta</i> (Walker 1855)	June–July	<0.01
7995	<i>Heterocampa biundata</i> Walker 1855	May–June	<0.01
7999	<i>Lochlmaeus bilineata</i> (Packard 1864)	August	<0.01
8007	<i>Schizura unicornis</i> (Smith 1797)	June, August	<0.01
ARCTIIDAE			
8045.1	<i>Crambidia pallida</i> Packard 1864	August	<0.01
8089	<i>Hypoprepia miniata</i> (Kirby 1837)	June, August	0.01
8121	<i>Holomelina aurantiaca</i> (Hubner 1827–31)	August	<0.01
8129	<i>Pyrrharctia isabella</i> (Smith 1797)	June, August	<0.01
8133	<i>Spilosoma latipennis</i> Stretch 1872	May–June	<0.01
8137	<i>Spilosoma virginica</i> (Fabricius 1798)	June–August	<0.01
8140	<i>Hyphantria cunea</i> (Drury 1773)	June	<0.01
8146	<i>Ecpantheria scribonia</i> (Stoll 1790)	June	<0.01
8169 +	<i>Apantesis</i> sp.	June, August	0.01
8203	<i>Halysidota tessellaris</i> Smith 1797	June–July	<0.01
8203 +	<i>Halysidota</i> sp.	July	<0.01
8211	<i>Lophocampa caryae</i> Harris 1841	May–June	<0.01
8230	<i>Cyenia tenera</i> Hubner 1818	June	<0.01
8231	<i>Cyenia oregonensis</i> (Stretch 1873)	June	<0.01
8238	<i>Euchaetes egle</i> (Drury 1773)	June–July	<0.01
8262	<i>Ctenucha virginica</i> (Esper 1794)	June	<0.01
8267	<i>Cisseps fulvicollis</i> (Hubner 1818)	June	<0.01

Table 1. Continued.

Hodges #	Taxa	Month(s) Collected	Proportion
LYMANTRIIDAE			
8316	<i>Orgyia leucostigma</i> (Smith 1797)	July	<0.01
8318	<i>Lymantria dispar</i> (Linnaeus 1758)	July–August	<0.01
NOCTUIDAE			
8322	<i>Idia americalis</i> (Guenee 1854)	June	<0.01
8323	<i>Idia aemula</i> Hubner 1813	June	<0.01
8334	<i>Idia lubricalis</i> (Geyer 1832)	July–August	<0.01
8347	<i>Zanclognatha obscuripennis</i> (Grote 1872)	August	<0.01
8348	<i>Zanclognatha pedipilalis</i> (Guenee 1854)	May–June	<0.01
8355	<i>Chytolita morbidalis</i> (Guenee 1854)	June	<0.01
8360	<i>Macrochilo orciferalis</i> Walker 1859	June, August	<0.01
8362	<i>Phalaenostola metonalis</i> (Walker 1859)	June, August	<0.01
8363	<i>Phalaenostola eumelusalis</i> (Walker 1859)	June, September	<0.01
8364	<i>Phalaenostola larentioides</i> Grote 1873	June–August	0.02
8368	<i>Tetanolita floridana</i> (Smith 1895)	September	<0.01
8370	<i>Bleptina caradrinalis</i> Guenee 1854	June–July	0.02
8386	<i>Renia adspersgillus</i> (Bosc 1800)	June	<0.01
8393	<i>Lascoria ambigualis</i> Walker 1866	August	<0.01
8397	<i>Palthis angulalis</i> (Hubner 1796)	June–July	<0.01
8398	<i>Palthis asopialis</i> (Guenee 1854)	August	<0.01
8465	<i>Plathypena scabra</i> (Fabricius 1798)	August–September	0.01
8479	<i>Spargaloma sexpunctata</i> Grote 1873	June	<0.01
8499	<i>Metalectra discalis</i> (Grote 1876)	July	<0.01
8534	<i>Plusiodonta compressipalpis</i> Guenee 1852	May–June	<0.01
8692	<i>Zale galbanata</i> (Morrison 1876)	June	<0.01
8738 +	<i>Caenurgina</i> sp.	May–September	0.02
8769	<i>Spiloloma lunilinea</i> Guenee 1873	July	<0.01
8874	<i>Catocola minuta</i> Edwards 1864	July	<0.01
8898	<i>Allagrapha aerea</i> (Hubner 1802–03)	September	<0.01
8907	<i>Megalographa biloba</i> (Stephens 1830)	April	<0.01
8908	<i>Autographa precationis</i> (Guenee 1852)	July–August	<0.01
8924	<i>Anagrapha falcifera</i> (Kirby 1837)	June	<0.01
8973	<i>Baileya australis</i> (Grote 1881)	May, July, August	<0.01
9047	<i>Lithacodia muscosula</i> (Guenee 1852)	June–July	<0.01
9053	<i>Pseudeustrotia carneola</i> (Guenee 1852)	May, June, August	<0.01
9055.1	<i>Maliattha synochitis</i> (Grote and Robinson 1868)	June	<0.01
9057	<i>Homophoberia apicosa</i> (Haworth 1809)	August	<0.01
9065	<i>Leuconycta diptheroides</i> (Guenee 1852)	June	<0.01
9095	<i>Tarachidia erastrionides</i> (Guenee 1852)	June, August	<0.01
9127	<i>Spragueia leo</i> (Guenee 1852)	July	<0.01
9199	<i>Acronicta rubricoma</i> Guenee 1852	August	<0.01
9332	<i>Apamea vulgaris</i> (Grote and Robinson 1866)	June	<0.01
9367	<i>Apamea dubitans</i> (Walker 1856)	August	<0.01
9402	<i>Oligia chlorositigna</i> (Harvey 1876)	June	<0.01
9457 +	<i>Amphipoea americana</i> (Speyer 1875)	July	<0.01
9473	<i>Papaipema impecuniosa</i> (Grote 1881)	September	<0.01
9484	<i>Papaipema baptisiae</i> (Bird 1902)	September	<0.01
9626	<i>Trachea delicata</i> (Grote 1874)	June	<0.01
9639	<i>Amphipyra tragopoginis</i> (Clerck 1759)	September	<0.01
9647	<i>Athetis miranda</i> (Grote 1873)	May, July, September	<0.01
9650	<i>Anorthodes tarda</i> (Guenee 1852)	August	<0.01
9663	<i>Balsa tristrigella</i> (Walker 1866)	June	<0.01
9666	<i>Spodoptera frugiperda</i> (Smith 1797)	August–September	<0.01
9688	<i>Galgula partita</i> Guenee 1852	April, June, July	0.02

Table 1. Continued.

Hodges #	Taxa	Month(s) Collected	Proportion
9720	<i>Ogdoconta cinereola</i> (Guenee 1852)	June	<0.01
9893	<i>Lithophane hemina</i> Grote 1874	April	<0.01
9957	<i>Sunira bicolorago</i> (Guenee 1852)	September	<0.01
10021	<i>Copivaleria grotei</i> (Morrison 1874)	April	<0.01
10300	<i>Spiramater grandis</i> (Guenee 1852)	June	<0.01
10368	<i>Lacinipolia meditata</i> (Grote 1873)	September	<0.01
10397	<i>Lacinipolia renigera</i> (Stephens 1829)	June–September	0.03
10405	<i>Lacinipolia lorea</i> (Guenee 1852)	June	<0.01
10438	<i>Pseudaletia unipuncta</i> (Haworth 1809)	April–September	0.02
10444	<i>Leucania phragmitidicola</i> Guenee 1852	June, September	<0.01
10445	<i>Leucania linda</i> Franclemont 1952	June	<0.01
10446 +	<i>Leucania</i> sp.	June, August	<0.01
10461 +	<i>Leucania</i> sp.	June, August	<0.01
10462	<i>Leucania pseudargyria</i> Guenee 1852	June	<0.01
10488	<i>Orthosia garmani</i> (Grote 1879)	April	<0.01
10501	<i>Crocigrapha normani</i> (Grote 1874)	May	<0.01
10524	<i>Nephelodes minians</i> Guenee 1852	September	<0.01
10585	<i>Orthodes crenulata</i> (Butler 1890)	August	<0.01
10587	<i>Orthodes cynica</i> Guenee 1852	May–June	0.04
10627	<i>Tricholota signata</i> (Walker 1860)	July	<0.01
10648	<i>Agrotis gladiaria</i> Morrison 1874	September	<0.01
10651	<i>Agrotis venerabilis</i> Walker 1857	September	<0.01
10663	<i>Agrotis epsilon</i> (Hufnagel 1766)	June, July, September	<0.01
10674 +	<i>Feltia</i> sp.	August–September	<0.01
10676	<i>Feltia herilis</i> (Grote 1873)	August–September	0.05
10803	<i>Euxoa velleripennis</i> (Grote 1874)	September	<0.01
10891	<i>Ochropleura plecta</i> (Linnaeus 1761)	July–August	<0.01
10942 +	<i>Xestia</i> sp.	June, September	0.01
10942.1	<i>Xestia dolosa</i> Franclemont 1980	May–June	<0.01
10950 +	<i>Xestia</i> sp.	September	<0.01
10955	<i>Xestia badinodis</i> (Grote 1874)	September	<0.01
10994	<i>Cerastis tenebrifera</i> (Walker 1865)	April	<0.01
10998	<i>Choephora fungorum</i> Grote and Robinson 1868	September	<0.01
11006	<i>Protolampra brunneicollis</i> (Grote 1865)	September	<0.01
11029	<i>Abagrotis alternata</i> (Grote 1864)	September	<0.01
11068	<i>Helicoverpa zea</i> (Boddie 1850)	August–September	<0.01
11149	<i>Schinia trifascia</i> Hubner 1818	August	<0.01
99999	<i>Noctua pronuba</i> Linnaeus 1758	June–August	<0.01

on the North Coleman Tract from 1999–2001; the North Coleman Tract is positioned slightly west of the center of the island. The trap was placed on the edge of a glacial groove that forms a small escarpment approximately 1 m above the valley floor (Fig. 1). The black light was turned on in the late afternoon before dusk, and specimens were recovered the next morning. The immediate area around the trap was cleared to remove woody vegetation during early summer 1999 to provide a

prairie remnant, leaving a forested environment surrounding the trap location.

The list of moths we obtained is indexed according to family and Hodges' number (Hodges et al. 1988). Specimens of questionable identification were given a Hodges' number for the species most closely approximating the specimen, and are identified on the list with a "plus" symbol (+) next to the Hodges' number. Although a more recent classification is available (Poole 1996), we used Hodges et al. (1988)

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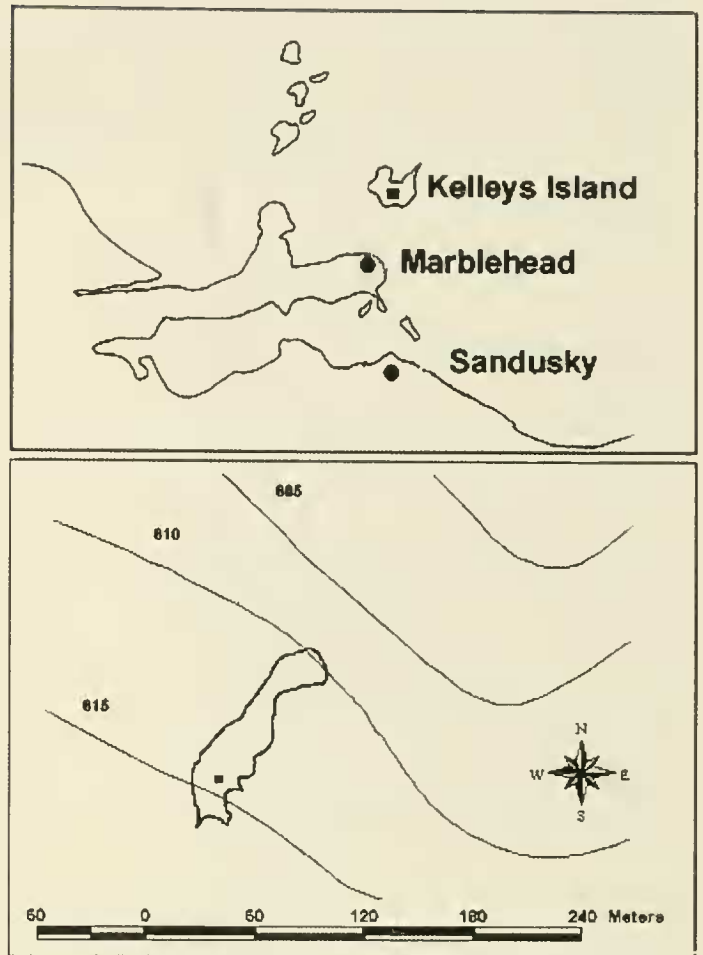
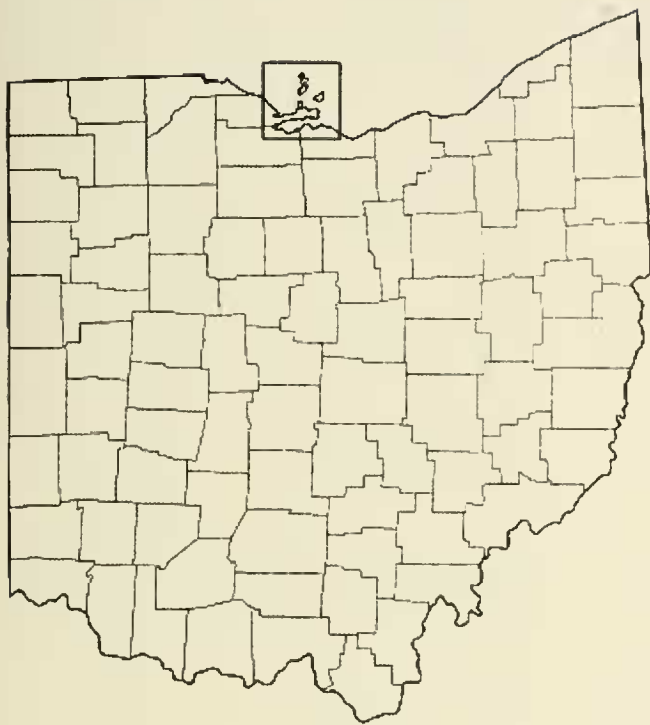


Fig. 1. Location of Kelleys Island in Lake Erie, and position of trap (filled square) on the North Coleman Tract. Contour lines show elevation in feet above sea level, and depict northward slope of trapping area.

and their numbering system to better place those species of questionable identification. Information on host plant use was taken from Holland (1903), Rings et al. (1992), and Rings and Downer (2001). All specimens are housed at The Cleveland Museum of Natural History, Department of Invertebrate Zoology.

To obtain an estimate of the actual number of moth species on Kelleys Island, data on species accumulation over ten years from the six papers prepared by Teraguchi

Table 2. Number of moth specimens, number of species, cumulative number of species, and number of new species captured for three year survey of Kelleys Island.

Year	No. Specimens	No. of spp.	Cumulative spp.	No. New spp.
1999	573	105	105	—
2000	408	103	163	58
2001	709	124	216	53

and Lublin (1999a–f) were combined, and the average rate of species accumulation from the six northeastern Ohio sites they sampled was determined. A logarithmic curve exhibited a good fit with their data ($y = 113.73 \ln(x) + 342.2$, $R^2 = 0.99$, where y is the cumulative number of species and x is the year of collection). We applied a logarithmic, non-linear regression to the three years of species accumulation data from this study to give a preliminary estimate of the number of species anticipated after 10 years of sampling on Kelleys Island.

The Kelleys Island flora was surveyed periodically during 1975–2002. Plants were identified or categorized using Fernald (1950), Voss (1996), and Rhoads and Block (2000). Representatives of all plant species taken were mounted on herbaria sheets, and are housed at The Cleveland Museum of Natural History, Department of Botany.

Table 3. The flora of Kelleys Island, with species found at the site of light trap setup on the Coleman Tract property.

Taxa	Common Name	Coleman Tract sp.
Thelypteridaceae		
<i>Thelypteris palustris</i> Schott	marsh fern	
Taxaceae		
<i>Taxus canadensis</i> Marsh	American yew	
Cupressaceae		
<i>Juniperus virginiana</i> L.	eastern red-cedar	X
Potamogetonaceae		
<i>Potamogeton pectinatus</i> L.	sago false pondweed	
<i>Potamogeton pusillus</i> var. <i>pusillus</i> L.	small pondweed	
<i>Potamogeton richardsonii</i> (Benn.) Rydb.	red-headed pondweed	
Alismataceae		
<i>Alisma subcordatum</i> Raf.	American water plantain	X
<i>Alisma triviale</i> Pursh	northern water plantain	X
Hydrocharitaceae		
<i>Elodea canadensis</i> L. C. Rich.	common waterweed	
<i>Vallisneria americana</i> Michx.	American eel-grass	
Poaceae		
<i>Agrostis stolonifera</i> var. <i>palustris</i> (Huds.) Farw.	spreading vent	
<i>Andropogon gerardii</i> var. <i>gerardii</i> Vitman	beardgrass	X
<i>Bromus erectus</i> Hudson	bromegrass	
<i>Dactylis glomerata</i> L.	orchard-grass	
<i>Elymus virginicus</i> var. <i>virginicus</i> L.	Virginia wild rye	X
<i>Festuca elatior</i> L.	fescue	
<i>Glyceria striata</i> (Lam.) A. Hitchc.	fowl mannagrass	
<i>Panicum flexile</i> (Gattinger) Scribn.	wiry panic grass	
<i>Panicum gattingeri</i> Nash	Gattinger's panic grass	
<i>Panicum implicatum</i> Scribn.	panic grass	X
<i>Panicum philadelphicum</i> Bernh.	Philadelphia panic grass	
<i>Phragmites australis</i> (Cav.) Trin. Ex Steud.	phragmites	
<i>Poa compressa</i> L.	Canada bluegrass	
<i>Poa pratensis</i> L.	Kentucky blue grass	X
<i>Sphenopholis intermedia</i> Rydb.	slender wedgescale	X
<i>Sporobolus ozarkanus</i> Fern.	dropseed	
<i>Triplasis purpurea</i> (Walt.) Chapman	purple sand grass	
Cyperaceae		
<i>Carex aggregata</i> Mackenzie	glomerata sedge	
<i>Carex amphibola</i> var. <i>turgida</i> Fern.	narrow-leaf sedge	X
<i>Carex aurea</i> Nutt.	golden-fruit sedge	
<i>Carex blanda</i> Dewey	eastern woodland sedge	X
<i>Carex cephalophora</i> Willd.	oval-leaf sedge	X
<i>Carex comosa</i> Boott	bearded sedge	
<i>Carex crawei</i> Dewey	Crawe's sedge	
<i>Carex davisii</i> Schwein. & Torr.	Davis' sedge	X
<i>Carex eburnea</i> Boott	bristle-leaf sedge	
<i>Carex flava</i> L.	yellow-green sedge	
<i>Carex garberi</i> Fern.	elk sedge	
<i>Carex granularis</i> Muhl. Ex Willd.	limestone-meadow sedge	X
<i>Carex lupulina</i> Willd.	hop-like sedge	
<i>Carex meadii</i> Dewey	Mead's sedge	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
<i>Carex molesta</i> McKenzie	troublesome sedge	X
<i>Carex muskingumensis</i> Schwein. & Torr.	sedge	X
<i>Carex oligocarpa</i> Willd.	Richwood's sedge	X
<i>Carex pellita</i> Muhl.	woolly sedge	
<i>Carex radiata</i> (Wahlen.) Small	eastern star sedge	
<i>Carex rosea</i> Schkuhr ex Willd.	rosy sedge	X
<i>Carex shortiana</i> Dewey	Short's sedge	X
<i>Carex sparganioides</i> Willd.	burr-reed sedge	X
<i>Carex stipata</i> Muhl. Ex Willd.	stalk-grain sedge	
<i>Carex umbellata</i> Schkuhr ex Willd.	parasol sedge	
<i>Carex viridula</i> Michx.	little green sedge	
<i>Carex vulpinoidea</i> Michx.	common fox sedge	
<i>Cladium mariscoides</i> (Muhl.) Torr.	twig-rush	
<i>Cyperus bipartitus</i> Torrey	shining flat sedge	
<i>Cyperus engelmannii</i> Steud.	Engelmann's umbrella sedge	
<i>Cyperus odoratus</i> L.	umbrella sedge	
<i>Eleocharis caribaea</i> (Rottb.) Blake	capitate spike rush	
<i>Eleocharis compressa</i> Sulliv.	flat-stem spike-rush	
<i>Eleocharis elliptica</i> Kunth	elliptic spike-rush	
<i>Eleocharis erythropoda</i> Steud.	spike-rush	
<i>Fimbristylis autumnalis</i> (L.) Roemer & Schultes	slender fimbry	
<i>Scirpus atrovirens</i> Willd.	dark-green bulrush	
<i>Scirpus lineatus</i> Michx.	bulrush	
<i>Scirpus pendulus</i> Muhl.	rufous bulrush	
<i>Scleria verticillata</i> Muhl. Ex Willd.	low nut-rush	
Pontederiaceae		
<i>Heteranthera dubia</i> (Jacq.) MacM.	grass-leaf mud plantain	
Juncaceae		
<i>Juncus alpinus</i> Vill.	northern green rush	
<i>Juncus articulatus</i> L.	joint-leaf rush	
<i>Juncus stuckeyi</i> Reinking	Stuckey's rush	
<i>Juncus tenuis</i> var. <i>uniflorus</i> (Farw.) Farw.	poverty rush	
<i>Juncus torreyi</i> Coville	Torrey's rush	X
Liliaceae		
<i>Allium canadense</i> L.	meadow garlic	X
<i>Allium cernuum</i> Roth	nodding onion	X
<i>Allium tricoccum</i> Ait.	ramp	
<i>Erythronium albidum</i> Nutt.	small white fawn-lily	
Iridaceae		
<i>Sisyrinchium albidum</i> Raf.	white blue-eyed grass	
<i>Sisyrinchium angustifolium</i> P. Mill.	blue-eyed grass	X
<i>Sisyrinchium montanum</i> Greene	strict blue-eyed grass	
<i>Sisyrinchium mucronatum</i> Michx.	needle tip blue-eyed grass	
Orchidaceae		
<i>Liparis loeselii</i> (L.) L. C. Rich.	yellow wide-lip orchid	
<i>Spiranthes cernua</i> (L.) L. C. Rich.	white nodding ladies'-tresses	
<i>Spiranthes magnicamporum</i> Sheviak	great plains ladies'-tresses	
Salicaceae		
<i>Populus deltoides</i> Bartr. Ex Marsh	eastern cottonwood	X
<i>Salix amygdaloides</i> Anderss.	peach-leaf willow	
<i>Salix bebbiana</i> Sarg.	gray willow	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
<i>Salix humilis</i> Marsh	prairie willow	
Juglandaceae		
<i>Carya ovata</i> (P. Mill.) K. Koch	shag-bark hickory	X
<i>Carya glabra</i> (Miller) Sweet.	pignut hickory	
<i>Juglans nigra</i> L.	black walnut	
Betulaceae		
<i>Betula pendula</i> Roth	European birch	
<i>Betula sandbergii</i> Britt.	hybrid (<i>papyrifera</i> × <i>pumila</i>)	
<i>Ostrya virginiana</i> (P. Mill.) K. Koch	eastern hop-hornbeam	
Fagaceae		
<i>Quercus macrocarpa</i> Michx.	burr oak	
Ulmaceae		
<i>Celtis occidentalis</i> L.	common hackberry	X
<i>Ulmus americana</i> L.	American elm	X
<i>Ulmus rubra</i> Muhl.	slippery elm	
<i>Ulmus thomasi</i> Sarg.	rock elm	
Moraceae		
<i>Morus alba</i> L.	white mulberry	X
Polygonaceae		
<i>Polygonum lapathifolium</i> L.	dock-leaf smartweed	
<i>Rumex crispus</i> L.	curlydock	
Chenopodiaceae		
<i>Chenopodium standleyanum</i> Aellen	Standley's goosefoot	
Molluginaceae		
<i>Mollugo verticillata</i> L.	carpet weed	
Portulacaceae		
<i>Claytonia virginica</i> L.	Virginia spring beauty	
Caryophyllaceae		
<i>Cerastium arvense</i> L.	field mouse-ear chickweed	
<i>Stellaria media</i> (L.) Vill.	common chickweed	
Ranunculaceae		
<i>Aquilegia canadensis</i> L.	red columbine	
<i>Clematis orientalis</i> L.	Oriental virgin's bower	
<i>Ranunculus micranthus</i> (Gray) Nutt. Ex Torr. & Gray	rock buttercup	X
<i>Ranunculus recurvatus</i> Poir.	blisterwort	
Fumariaceae		
<i>Dicentra cucullaria</i> (L.) Bernh.	Dutchman's breeches	
Brassicaceae		
<i>Alliaria petiolata</i> (Bieb.) Cavara & Grande	garlic-mustard	
<i>Arabidopsis thaliana</i> (L.) Heynh.	thalecress	
<i>Arabis glabra</i> (L.) Bernh.	tower-mustard	
<i>Arabis hirsuta</i> var. <i>adpressipilis</i> (M. Hopkins) Rollins	hairy rockcress	
<i>Cardamine concatenata</i> (Michx.) O. E. Schulz	cut-leaf toothwort	
<i>Cardamine douglassii</i> (Torr.) Britt.	limestone bittercress	
<i>Cardamine hirsuta</i> L.	hairy bittercress	
<i>Diplotaxis muralis</i> (L.) DC.	wall or sand rocket	
<i>Hesperis matronalis</i> L.	dame's rocket	
<i>Rorippa palustris</i> ssp. <i>hispida</i> (L.) Bess. (Desv.) Jonsell	bog yellowcress	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
Saxifragaceae		
<i>Heuchera americana</i> L.	American alumroot	
Grossulariaceae		
<i>Ribes americanum</i> P. Mill.	wild black currant	X
Rosaceae		
<i>Amelanchier arborea</i> (Michx. F.) Fern.	downy service-berry	
<i>Amelanchier spicata</i> (Lam.) K. Koch	service-berry	
<i>Fragaria virginiana</i> Duchesne.	thick-leaved wild strawberry	
<i>Geum canadense</i> Jacq.	white avens	
<i>Geum vernum</i> (Raf.) Torr. & Gray	spring avens	X
<i>Malus pumila</i> Mill.	apple	
<i>Physocarpus opulifolius</i> (L.) Maxim.	Atlantic ninebark	
<i>Potentilla fruticosa</i> L.	cinquefoil	
<i>Potentilla paradoxa</i> Nutt. Ex T. & G.	bushy cinquefoil	
<i>Potentilla simplex</i> Michx.	oldfield cinquefoil	
<i>Prunus mahaleb</i> L.	perfumed cherry	
<i>Prunus virginiana</i> L.	choke cherry	
<i>Rosa blanda</i> Ait.	smooth rose	
<i>Rosa carolina</i> L.	Carolina rose	X
<i>Rosa multiflora</i> Thunb.	multiflora rose	
<i>Rubus allegheniensis</i> T.C. Porter	common blackberry	
<i>Rubus pensilvanicus</i> Poiret.	Pennsylvania blackberry	
Fabaceae		
<i>Desmodium canescens</i> (L.) DC.	hoary tick-trefoil	
<i>Gleditsia tricanthos</i> L.	honey-locust	
<i>Gymnocladus dioica</i> (L.) K. Koch	Kentucky coffee tree	
<i>Medicago lupulina</i> L.	black medick	
Oxalidaceae		
<i>Oxalis stricta</i> L.	common yellow wood-sorrel	
Geraniaceae		
<i>Geranium carolinianum</i> L.	Carolina crane's-bill	X
<i>Geranium pusillum</i> L.	small-flowered crane's-bill	
Rutaceae		
<i>Ptelea trifoliata</i> L.	common hoptree	X
<i>Zanthoxylum americanum</i> P. Mill.	toothache tree	X
Euphorbiaceae		
<i>Acalypha rhomboidea</i> Raf.	common three-seed-mercury	
<i>Euphorbia maculata</i> L.	eyebane	
<i>Euphorbia polygonifolia</i> L.	seaside spurge	
Anacardiaceae		
<i>Rhus aromatica</i> Ait.	fragrant sumac	X
<i>Rhus aromatica</i> var. <i>arenaria</i> (Greene) Fern.	fragrant sumac	
<i>Rhus glabra</i> L.	smooth sumac	
<i>Rhus radicans</i> L.	poison ivy	X
Celastraceae		
<i>Celastrus scandens</i> L.	American bittersweet	
Staphyleaceae		
<i>Staphylea trifolia</i> L.	American bladdernut	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
Aceraceae		
<i>Acer platanoides</i> L.	Norway maple	
<i>Acer saccharum</i> Marsh	sugar maple	
Hippocastanaceae		
<i>Aesculus glabra</i> var. <i>arguta</i> (Buckl.) B.L. Robins.	Ohio buckeye	
Vitaceae		
<i>Parthenocissus inserta</i> (Kern.) Fritsch	Virginia creeper	
<i>Vitis riparia</i> Michx.	river-bank grape	
Tiliaceae		
<i>Tilia americana</i> L.	American basswood	X
Clusiaceae		
<i>Hypericum perforatum</i> L.	common St. John's-wort	
Violaceae		
<i>Viola affinis</i> LeConte	sand violet	
<i>Viola pubescens</i> Ait.	downy yellow violet	
Elaeagnaceae		
<i>Elaeagnus umbellata</i> Thunb.	autumn olive	
Lythraceae		
<i>Lythrum alatum</i> Pursh	wing-angle loosestrife	
Onagraceae		
<i>Oenothera parviflora</i> L.	northern evening-primrose	
Haloragidaceae		
<i>Proserpinaca palustris</i> L.	mermaid-weed	
Apiaceae		
<i>Daucus carota</i> L.	queen anne's-lace	
<i>Thaspium barbinode</i> (Michx.) Nutt.	hairy-jointed meadow parsnip	
Cornaceae		
<i>Cornus amomum</i> spp. <i>amomum</i> P. Mill.	silky dogwood	
<i>Cornus amomum</i> ssp. <i>obliqua</i> (Raf.) J.S. Wilson	silky dogwood	
<i>Cornus drummondii</i> C. A. Mey.	rough-leaf dogwood	X
Primulaceae		
<i>Lysimachia quadriflora</i> Sims	four-flower yellow-loosestrife	
Oleaceae		
<i>Fraxinus americana</i> L.	white ash	X
<i>Fraxinus pennsylvanica</i> Marsh	red ash	X
<i>Fraxinus quadrangulata</i> Michx.	blue ash	X
Apocynaceae		
<i>Apocynum cannabinum</i> L.	Indian-hemp	X
<i>Vinca minor</i> L.	lessor periwinkle	
Asclepiadaceae		
<i>Asclepias incarnata</i> L.	swamp milkweed	
<i>Asclepias syriaca</i> L.	common milkweed	X
<i>Asclepias tuberosa</i> L.	butterfly weed	
<i>Asclepias tuberosa</i> ssp. <i>tuberosa</i> L.	butterfly weed	
<i>Asclepias verticillata</i> L.	whorled milkweed	
<i>Asclepias viridiflora</i> Raf.	green milkweed	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
Polemoniaceae		
<i>Phlox divaricata</i> L.	wild blue phlox	X
Hydrophyllaceae		
<i>Phacelia purshii</i> Buckl.	Miami-mist	
Boraginaceae		
<i>Lappula squarrosa</i> (Retz.) Dumort.	bristly sheepburr	
Verbenaceae		
<i>Verbena simplex</i> Lehm.	narrow-leaf vervain	
Lamiaceae		
<i>Clinopodium vulgare</i> L.	wild basil	
<i>Lamium purpureum</i> L.	red henbit	
<i>Lycopus americanus</i> Muhl. Ex Bart.	cut-leaf water-horehound	
<i>Lycopus europaeus</i> L.	gypsywort	
<i>Lycopus sherardii</i> Steele	water-horehound	
<i>Lycopus uniflorus</i> Michx.	northern water-horehound	
<i>Mentha piperita</i> L.	water mint	
<i>Nepeta cataria</i> L.	catnip	
<i>Scutellaria parvula</i> Michx.	small skullcap	
<i>Trichostema brachiatum</i> L.	false penny royal	
Scrophulariaceae		
<i>Chaenorrhinum minus</i> (L.) Large	dwarf-snapdragon	
<i>Leucospora multifida</i> (Michx.) Nutt.	narrow-leaf paleseed	
<i>Penstemon hirsutus</i> (L.) Willd.	hairy beard tongue	
<i>Scrophularia marilandica</i> L.	carpenter's square	
Bignoniaceae		
<i>Campsis radicans</i> (L.) Seem. Ex Bureau	trumpet-creeper	
Plantaginaceae		
<i>Plantago rugelii</i> Decne.	American plantain	
Rubiaceae		
<i>Galium mollugo</i> L.	false baby's breath	X
<i>Hedyotis nigricans</i> (Lam.) Fosberg	diamond flowers	
Caprifoliaceae		
<i>Lonicera morrowii</i> A. Gray	morrow's honeysuckle	
Campanulaceae		
<i>Campanula americana</i> L.	American bellflower	
<i>Lobelia kalmii</i> L.	kalm's lobelia	
Asteraceae		
<i>Aster ericoides</i> L.	many-flowered aster	
<i>Aster novae-angliae</i> L.	New England American aster	
<i>Aster pilosus</i> var. <i>demotus</i> Blake	heath aster	
<i>Aster pilosus</i> var. <i>pilosus</i> Willd.	heath aster	
<i>Aster pilosus</i> var. <i>pringlei</i> (Gray) Blake	Pringle's American aster	
<i>Aster shortii</i> Lindl.	Short's American aster	
<i>Aster simplex</i> Willd.	panicked aster	X
<i>Bidens cernua</i> L.	nodding bar marigold	
<i>Bidens bipinnata</i> L.	Spanish-needles	
<i>Cirsium arvense</i> L. Scop.	Canada thistle	
<i>Cirsium discolor</i> (Muhl. Ex Willd.) Spreng.	field thistle	

Table 3. Continued.

Taxa	Common Name	Coleman Tract sp.
<i>Chrysanthemum leucanthemum</i> L.	ox-eye daisy	
<i>Eclipta prostrata</i> (L.) L.	yerba-de-tajo	
<i>Eupatorium altissimum</i> L.	tall thoroughwort	
<i>Eupatorium perfoliatum</i> L.	boneset	
<i>Euthamia graminifolia</i> (L.) Nutt. Ex Cass.	flat-top goldentop	
<i>Hieracium lactucella</i> Wallr.	hawkweed	
<i>Lactuca floridana</i> (L.) Gaertn.	woodland lettuce	
<i>Liatris spicata</i> (L.) Willd.	blazing-star	
<i>Polymnia canadensis</i> L.	white flower leafcup	X
<i>Senecio pauperculus</i> Michx.	ragwort	X
<i>Solidago canadensis</i> var. <i>salebrosa</i> (Piper) M. E. Jones	Canadian goldenrod	
<i>Solidago gigantea</i> Aiton.	smooth goldenrod	
<i>Solidago nemoralis</i> Ait.	gray goldenrod	
<i>Taraxacum officinale</i> Weber	common dandelion	

RESULTS AND DISCUSSION

We collected 1,690 moths representing 216 species from 20 families (Table 1). Noctuidae was the most species-rich family collected with 89 species taken, followed by Geometridae (33), Crambidae (24), Arctiidae (17), Notodontidae (17), and Tortricidae (14). Combined, those six families represent 89.8% of the total species taken. All other families were represented by 1–7 species.

Twenty-two (10.2%) species each represented $\geq 1\%$ of the total catch. *Crambus agitatellus* (Crambidae) was the most numerous, representing 12.2% of the total catch (Table 1). This species demonstrated a moderately long flight period from June to August on Kelleys Island, and the larvae are known to feed on grasses.

Three species exhibited a long flight period spanning April through September: *Udea rubigalis* (Crambidae), *Eupethecia* sp. (Geometridae), and *Pseudaletia unipunctata* (Noctuidae). Of these, only *P. unipunctata* was taken frequently, and represented approximately 2% of all moth specimens obtained. All three species are known to be highly polyphagous on a variety of plants, including woody and herbaceous forms. Ten species were limited to an early flight period spanning only April and/or

May: *Plutella xylostella* (Plutellidae), *Palpita magniferalis* (Crambidae), *Antepione thisoaria* (Geometridae), *Deidama inscripta* (Sphingidae), *Clostera inclusa* (Notodontidae), and the noctuids *Lithophane hemina*, *Copivaleria grotei*, *Orthosia garmani*, *Crocigraha normani*, and *Cerastis tenebrifera*. All ten species are restricted to feeding on trees or cultivated plants as larvae. No early flying species were taken in any abundance. Conversely, 20 moth species were restricted to a late flight period (September only) on Kelleys Island: *Crambus leachelus* (Crambidae), *Hypsopygia costalis* (Crambidae), *Prochoerodes transversata* (Geometridae), *Haematopsis grataria* (Geometridae), *Tolyte velleda* (Lasiocampidae), and the noctuids *Tetanolita floridana*, *Allagrapha aerea*, *Papaipema impunctiosa*, *P. baptisiae*, *Amphipyra tragopoginis*, *Sunira bicolorago*, *Lacinipolia meditata*, *Nephelodes minians*, *Agrotis gladiaria*, *A. venerabilis*, *Xestia* sp., *X. badinodis*, *Choephora fungorum*, *Protolampra brunneicollis*, and *Abagrotis alternata*. No late flight species represented $\geq 1\%$ of the total catch. Unlike the species that are restricted to an early flight period, the 20 late flight species are all highly polyphagous on woody and herbaceous vegetation as larvae.

Yearly species accumulation data show

that 111 species were collected during the second and third year of trapping that were not collected during the first year. The third year of collecting was the most species-rich with 124 species (Table 2). Applying a logarithmic equation to the species accumulation data provided a good fit ($R^2 = 0.99$; $y = 99.2 \text{ Ln}(x) + 102.1$), and gives an estimate that 330.5 moth species are anticipated after ten years of collecting. This suggests that three years of effort have obtained 65% of the moth species on the island.

Two-hundred-thirty-eight plant species from 65 families were found on the island, and are listed in Table 3. The Cyperaceae was the most species rich family with 39 species, and *Carex* spp. alone accounted for 26 species. Forty-nine species (23.1%) were collected from the North Coleman Tract. Comparing the calculated estimate of the number of moth species expected after ten years of collecting indicates that there are 1.39 moth species per plant species on Kelleys Island. This implies that multiple insect herbivores put pressure on the Kelleys Island flora. Competitive interactions or niche packing may be limiting the number of moth species that the island can support. This is the only study we are aware of that can provide a predictive ratio (approximately 1.4 lepidopteran herbivore species per plant species) for a herbivore community and its food sources.

This study shows that, even when a relatively small area of terrestrial habitat is sampled (i.e., no confounding data obtained by moths flying in from areas outside of our sampling area), moths represent a species-rich community. Rings et al. (1987) attempted to associate the moth species they accumulated during a survey conducted in northeastern Ohio with their natural host plants. They were unsuccessful and determined that this could not be done because the complete host range for most Lepidoptera is unknown, and that moth species can be captured at great distances from their host plants using light traps. Although we

conducted no rearings, the concurrent presentation of moth and plant species data from an insular environment may help other lepidopterists determine the host plant range of the moth species found during this study.

Three years of data collection provided approximately two-thirds of the moth species anticipated after ten years of effort. Surveys of the entomofauna of a given area are hampered by rare taxa that may not be captured without long-term efforts. These results underscore the need for long-term survey work when dealing with Lepidoptera, or any other speciose insect taxa.

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